ABSTRACT OF THE DISCLOSURE

In damascene process integration, a reducing plasma is applied after the etch stop or barrier layer is opened over a copper layer. Currently known methods for opening barrier layers suffer from the disadvantage that they cause at least some of the underlying copper to oxidize to copper oxide.. Because copper oxide is selectively removed by subsequent wet cleaning, voids can form where damaged copper (*e.g.*, copper oxide) is removed, thus compromising the reliability of metal-to-metal contact in vias. The present invention advantageously overcomes this and other disadvantages of the prior art through the use of a hydrogen plasma following the barrier layer opening step, which repairs damaged copper (*e.g.*, reduces copper oxide to copper), thus preventing and/or diminishing defects in metal-to-metal contacts in vias and concomitantly improving the reliability of the same.

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